ARTICLE 1

TB INFECTION CONTROL RECOMMENDATIONS FROM THE CDC, 1994: CONSIDERATIONS FOR DENTISTRY

JENNIFER L. CLEVELAND, D.D.S., M.P.H.; BARBARA F. GOOCH, D.M.D., M.P.H.; ELIZABETH A. BOLYARD, R.N., M.P.H.; PATRICIA M. SIMONE, M.D.; ROBERT J. MULLAN, M.D.; DONALD W. MARIANOS, D.D.S., M.P.H.

A B S T R A C T

Between 1989 and 1992, reports of outbreaks and transmissions of tuberculosis in institutional settings prompted the Centers for Disease Control and Prevention to review the guidelines for TB infection control it had published in 1990. The CDC published an updated version of the guidelines in October 1994. This article gives dentists an overview of the guidelines' recommendations that are applicable to most outpatient dental settings.

The Centers for Disease Control and Prevention published Guidelines for Preventing the Transmission of Tuberculosis in Health-Care Settings, with Special Focus on HIV-Related Issues[1] in December 1990. Partially in response to recent reports of TB outbreaks and transmission of *Mycobacterium tuberculosis* in institutional settings,[2-7] the Federal TB Task Force called for the update and revision of the CDC guidelines. On Oct. 28, 1994, the CDC published Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health Care Facilities, 1994.[8]

At an October 1992 public meeting about the 1990 TB infection control guidelines, the CDC received suggestions that infection control policies should be based, in part, on the level of risk in each local facility. As a consequence, the revised guidelines direct personnel in all health care facilities to conduct a TB risk assessment. This risk assessment will allow health care personnel to implement TB infection control programs appropriate to their facility's level of risk of *M. tuberculosis* transmission. It also will provide greater flexibility in adapting the recommended controls to a wide variety of health care facilities, such as dental settings, in which few or no patients with TB are examined or treated.

The guidelines emphasize
- basing infection control policies on a hierarchy of control measures, including administrative controls, engineering controls and personal respiratory protection (Table 1);
- developing, implementing and maintaining a written TB infection control plan based on a risk assessment;
- providing TB training, education, counseling and screening to health care workers (HCWs);
- evaluating TB infection control programs.

This article should assist dental workers (DWs) in conducting a risk assessment and in identifying TB infection control interventions appropriate to the level of risk for *M. tuberculosis* transmission in the dental facility.

Although the CDC guidelines are directed primarily at in-patient health care facilities, specific considerations for ambulatory care settings—such as dental offices—are discussed in a separate section [Section II.M.2.e] (see sidebar, "CDC Guidelines for Dental Care Settings," page 600) with appropriate references to other parts of the guidelines. In this article, references to specific sections of the CDC guidelines are indicated in brackets. The term "HCWs" refers to all persons working in health care settings who could be exposed to TB. The terms dental facility, dental setting and dental office are used interchangeably and refer to any location, whether a private practice or part of a larger institution, in which dental treatment is provided.

TRANSMISSION AND PATHOGENESIS [SECTION I.B]

TB is a clinical illness caused by the bacterium *M. tuberculosis*.

TABLE 1

HIERARCHY OF CONTROLS FOR PREVENTING TUBERCULOSIS.

Administrative controls
Policies and protocols for early identification and prompt isolation of patients with active TB
Skin test surveillance for health care workers
Worker training and education
Effective work practices
Engineering controls
Local exhaust ventilation (for example, booths or hoods)
General ventilation
Negative pressure for achieving directional airflow
High-efficiency particulate air filtration
Ultraviolet germicidal irradiation
Personal respiratory protection
Personal respiratory protective devices
Respiratory protection program

Effective prevention and control of *M. tuberculosis* is based on a clear understanding of how TB is transmitted, how infection becomes established and how infection progresses to clinical disease.

M. tuberculosis is spread through airborne particles, known as droplet nuclei, that can be generated when persons with pulmonary or laryngeal TB sneeze, cough, speak or sing. The particles are an estimated 1 to 5 microns in size, and normal air currents can keep them airborne for prolonged periods and spread them throughout a room or building.[9] If a person inhales droplet nuclei containing TB bacilli, infection may begin if the bacilli reach the alveoli. Within two to 10 weeks, the body's immunologic response to TB bacilli usually prevents further multiplication and spread. This condition is referred to as latent TB infection.

Persons with latent TB infection usually have a positive skin test reaction to tuberculin purified protein derivative (PPD), do not have active TB and cannot infect others. In about 90 percent of Americans infected with TB, the infection remains latent for life, with no progression to active TB. In the United States, active TB disease will develop in the first year or two after infection with *M. tuberculosis* in about 5 percent of people who have been recently infected. In another 5 percent, disease will develop later in life. The risk of developing active TB varies with age and immunologic status.[10]

In general, people not receiving treatment who have or who are suspected of having pulmonary or laryngeal TB should be considered infectious if they are coughing, are undergoing cough-inducing or aerosol-generating procedures or have sputum smears that are positive for acid-fast bacilli [Suppl. 1]. Persons with extrapulmonary TB are not considered infectious unless they have concomitant pulmonary disease, nonpulmonary disease located in the respiratory tract or oral cavity or extrapulmonary disease that includes an open abscess or lesion. Coinfection of human immunodeficiency virus does not appear to affect the infectiousness of patients with TB.

Hierarchy of control measures. A facility's TB infection control program should be based on a hierarchy of control measures (Table 1) and should be appropriate for the facility's level of risk of *M. tuberculosis* transmission (Table 2). The first level in the hierarchy is the use of administrative controls, which are intended primarily to reduce the risk of exposing uninfected people to people who have infectious TB. These measures include developing and implementing policies and protocols for early identification and isolation of patients suspected of having active TB or, in facilities that do not have TB isolation capabilities, for referral to a collaborating facility that does have such capabilities. Other administrative measures include ensuring the use of effective work practices, performing PPD skin testing on HCWs and educating HCWs about TB.

The second level of the hierarchy includes engineering controls to prevent the spread and reduce the concentration of infectious droplet nuclei. These controls may include the use of local exhaust devices (such as booths or hoods), the dilution and removal of contaminated air via general ventilation, controlling the direction of airflow and cleaning air by filtration or—as an adjunct to ventilation—by ultraviolet germicidal

TABLE 2

FACTORS THAT DETERMINE RISK CATEGORY FOR DENTAL SETTINGS.

Factor	Risk Category
Does not treat patients with active tuberculosis and no TB cases have been reported in the community in the preceding 12 months*	Minimal risk
Does not treat patients with active tuberculosis but TB cases are reported in the community; screens patients for active TB and refers suspected TB cases to collaborating facility for evaluation and management	Very low risk
Provides treatment to fewer than six patients with active TB per year and there is no evidence of *Mycobacterium tuberculosis* transmission in the facility†	Low risk
Provides treatment to six or more patients with active *M. tuberculosis* per year and there is no evidence of TB transmission in the family	Intermediate risk
Evidence of transmission of *M. tuberculosis* in the facility	High risk

* Incidence of TB in the community should be available from the local public health department.
† As evidenced by PPD skin test conversions among dental workers or patients.

irradiation (UVGI).

The third level of the hierarchy is the use of personal respiratory protection devices in settings such as TB isolation rooms, where administrative and engineering controls may not provide adequate protection.

RISK ASSESSMENT, DEVELOPMENT OF THE TB INFECTION CONTROL PLAN AND PERIODIC REASSESSMENT [SECTION II.B]

In all dental settings, an initial or baseline risk assessment should be conducted by a designated person who understands the basic principles of infection control and can adapt TB infection control recommendations according to the facility's level of risk for *M. tuberculosis* transmission. In institutional dental settings, this person may be the hospital epidemiologist, an infection control practitioner or an occupational health specialist. In non-institutional dental settings, such as private dental offices, the risk assessment usually is conducted by the dentist or another staff member who has been assigned responsibility for the office's infection control program. Sources for training specific to TB infection control risk assessment may include the local public health department, state or local dental society, academic institutions, a local infection control organization or an infection control practitioner in a local hospital. The guidelines recommend that the risk assessment should be conducted for each area of the facility. Since most dental settings constitute an entire "area," a single risk assessment should be sufficient.

Risk categories. Each dental facility should be classified into one of five defined categories of risk for *M. tuberculosis* transmission: minimal, very low, low, intermediate or high (Table 2). This classification should be based on three factors. The first factor is the incidence of active TB in the community or county served by the facility. This information should be available from the local or county public health department. The second factor is the number of patients with active TB who received dental treatment in the facility during the preceding 12 months (this does not include patients who were promptly screened and referred). The third factor is possible transmission of *M. tuberculosis* in the facility as evidenced by PPD skin test conversions among DWs or evidence of transmission between patients in the dental setting.

Minimal risk. Most dental settings probably will fall into the minimal- or very-low-risk categories. A dental setting at minimal risk is one that does not provide treatment to patients with active TB and is located in a community in which no TB cases have been reported during the previous 12 months.

TABLE 3

ELEMENTS OF A TB INFECTION CONTROL PROGRAM FOR DENTAL SETTINGS.*

Element	RISK CATEGORIES		
	Minimal	Very Low	Low†
Assigning responsibility for conducting risk assessment	R	R	R
Baseline risk assessment	R	R	R
Community TB profile	R	R	R
Written TB infection control plan	R	R	R
Reassessment of risk	Y	Y	Y
Protocol for identifying and referring patients who may have active TB	R	R	R
Protocol for managing patients with active TB relative to providing urgent dental care	R‡	R‡	R§
Engineering controls	N/A*	O**	R
Respiratory protection program	N/A*	N/A*	R
Educating and training dental workers regarding TB	R	R	R
Counseling dental workers regarding TB	R	R	R
Baseline PPD testing of dental workers	O	R	R
Periodic PPD testing of dental workers	N/A	N/A*	Y
Protocol of identifying and referring dental workers who may have active TB and/or positive PPD test results	R	R	R
Protocol for investigating unprotected occupational exposures to TB	R	R	R

R = recommended; Y = yearly; N/A = not applicable; O = optional.
* This table is specific for dental settings and may differ from Table 2 [Elements of a TB infection-control program] in the guidelines.[1]
† Intermediate and high-risk dental settings may need to perform some elements more frequently.
‡ Minimal- and very-low-risk dental settings should identify appropriate dental facilities for referral of patients in need of evaluation, management or urgent dental treatment.
§ Low-, intermediate- or high-risk dental facilities providing dental treatment to patients who have, or are strongly suspected of having, infectious TB should provide TB isolation [Section II.E].
** Some very-low-risk dental settings providing treatment to patients at high risk for active TB may elect to use engineering controls for general-use areas (for example, waiting rooms). These controls may include general ventilation, high-efficiency particulate air filtration or ultraviolet germicidal irradiation [Section II.F].

Very low risk. In a very-low-risk dental setting, TB cases have been reported in the community, but no patients with active TB have been treated in the facility during the preceding 12 months. Because DWs do not provide initial medical assessment of patients who may have TB, but only conduct a limited screening of patients for symptoms of active TB before providing dental treatment, the very-low-risk category is appropriate for many dental settings. Based

on this initial screening, patients suspected of having active TB should be referred promptly to a collaborating facility for medical evaluation and, when indicated, urgent dental treatment.

Low risk and intermediate risk. Some dental settings may be classified in the low-risk or intermediate-risk categories. The low-risk facility provides treatment to fewer than six patients with active TB a year. In addition, the low-risk facility has no evidence of transmission of *M. tuberculosis* among DWs or patients.

Dental facilities that provide dental treatment to more than six patients with active TB each year, but have no evidence of *M. tuberculosis* transmission in the facility, are categorized as being at intermediate risk. A dental facility at low or intermediate risk might be one that accepts patients with known or suspected active TB for urgent dental care that must be performed before the diagnosis of TB is ruled out or the patient has received adequate treatment for the disease.

High risk. High-risk dental facilities are those in which the PPD conversion rate exceeds the previous rate in the same facility or group, or in which a cluster of PPD conversions has occurred, suggesting transmission of *M. tuberculosis* among DWs or patients. Many dental facilities have only a small number of DWs, which makes it difficult to interpret skin test conversions. Thus, to determine the significance of conversions, a practitioner should obtain appropriate consultation from the public health department or other sources of expertise.

From risk assessment to written program. Based on the risk assessment, a written TB infection control program should be developed for each dental facility (Table 3). Elements of an infection control program for dental settings at minimal, very low and low risk may differ from those outlined in the CDC guidelines [Table 2]. For minimal-, very-low- and low-risk dental settings, a follow-up risk assessment should occur at least annually. Based on the results of the follow-up assessment, a problem evaluation [Section II.K] may need to be conducted or the facility's risk classification changed. For example, the very-low-risk category may be appropriate for many dental facilities. If, however, patients with active TB have received dental treatment in a facility classified as being at very low risk, the facility should be assigned to the appropriate low, intermediate- or high-risk category. Categorical assignment will depend on the number of patients with TB treated in the facility during the preceding 12 months and whether there is evidence of nosocomial transmission of *M. tuberculosis* in the dental facility.

> *Most dental settings probably will fall into the minimal- or very-low risk categories.*

Elements of TB infection control for intermediate- and high-risk facilities are discussed in detail in the guidelines [Section II.B]. In general, intermediate-risk and high-risk facilities should perform the same elements of an infection-control program for a low-risk facility but should perform some elements more frequently.

IDENTIFYING AND MANAGING PATIENTS WHO MAY HAVE ACTIVE TB [SECTION II.C]

Although dental personnel are not responsible for diagnosing and treating TB, they should be trained to recognize and refer patients with signs and symptoms that suggest TB, such as a productive and persistent cough, bloody sputum, night sweats, weight loss, fever or anorexia. The index of suspicion for infectious TB among dental patients will vary and depend on the prevalence of TB in and other characteristics of the population that the facility serves [Section I.B].

Medical histories should be updated at each dental appointment and should include questions about symptoms of TB and about current treatment for active TB. Any patient whose medical history or symptoms are suggestive of active TB should be placed in an area separate from other patients or dental personnel, asked to wear a surgical mask to reduce expulsion of respiratory secretions into the air, provided tissues for coughing or sneezing and referred promptly for medical evaluation and, when indicated, urgent dental treatment.

MANAGING PATIENTS WITH ACTIVE TB RELATIVE TO PROVIDING DENTAL CARE [SECTION II.D]

Elective dental treatment should be deferred for patients known or suspected of having active TB until they are receiving effective treatment and are no longer infectious [Suppl. 1]. Low-, intermediate- or high-risk facilities that provide urgent dental treatment to patients

with active TB should be equipped with an appropriate isolation room [Section II.E]. Respiratory protection is recommended for dental personnel providing such treatment, and this protection should meet current CDC guideline recommendations [Section II.G].

Each dental office in the minimal- or very-low-risk category should identify collaborating facilities that are capable of evaluating, managing and/or providing urgent dental treatment to patients with suspected or active TB. These facilities should be identified before DWs or patients are placed at risk of possible exposure to *M. tuberculosis* so that patients suspected of having TB may be referred promptly. The dental office and collaborating facility should establish a referral agreement to prevent inappropriate management and inadequate follow-up of patients who may have active TB.

ENGINEERING CONTROLS FOR GENERAL-USE AREAS [SECTION II.F]

Dental facilities treating patient populations at high risk for active TB may elect to use engineering controls in general-use areas (waiting rooms, for example). Such engineering controls may include general ventilation for dilution and removal of potentially contaminated air, high-efficiency particulate air filtration (HEPA) or UVGI. Protocols for maintenance of this equipment should be evaluated periodically.

RESPIRATORY PROTECTION [SECTION II.G]

DWs who perform procedures on patients who have, or are strongly suspected of having, infectious TB should use personal respiratory protection. Therefore, low-, intermediate- and high-risk dental settings need to have a respiratory protection program for TB.

The CDC guidelines do not recommend a specific respirator but have outlined standard performance criteria for respirators used in health care settings for protection against *M. tuberculosis.* The Occupational Safety and Health Administration respirator protection standard requires that all respiratory protective devices used in the workplace be certified by the National Institute for Occupational Safety and Health, a component of the CDC. NIOSH-approved HEPA filter respirators are the only currently available air-purifying respirators that meet or exceed the standard performance criteria recommended by the CDC. The NIOSH respiratory certification procedures are being revised to take advantage of new technology that will enable respirators to meet the standard performance criteria for TB respirators at lower cost and greater comfort.[11]

> *Elective dental treatment should be deferred for patients known or suspected of having active TB until they are receiving effective treatment and are no longer infectious.*

EDUCATION, TRAINING, AND COUNSELING [SECTION II.I AND II.J]

All DWs should receive periodic employer-sponsored TB education and training appropriate for the dental facility's risk category and for their individual job category. The program should include

- the basic concepts of pathogenesis and transmission of *M. tuberculosis;*
- the difference between latent TB infection and active disease;
- the signs and symptoms of TB;
- the management and referral of patients suspected of having infectious TB;
- the principles of TB infection control;
- additional control measures appropriate for facilities at higher risk.

All DWs should receive counseling about TB infection and about the increased risk for some immunocompromised persons of developing active TB once infected. The need for additional training should be evaluated periodically by the person responsible for TB infection control in the office.

SCREENING HCWS FOR LATENT OR ACTIVE TB INFECTION [SECTION II.J]

The risk assessment should be used to determine the need for a DW skin-testing program and the appropriate frequency of such testing. Baseline PPD skin testing of all DWs, performed by trained personnel, is recommended at the beginning of employment for facilities in all risk categories except minimal risk. However, baseline PPD skin testing of DWs in the minimal-risk category may be advisable so that if an unprotected exposure occurs, skin test conversions can be distinguished from positive PPD test results caused by previous exposures. DWs whose PPD test results are negative and who work in low-,

intermediate- and high-risk facilities should undergo repeated PPD testing at regular intervals as determined by the risk assessment. In addition, DWs should be tested whenever they have been exposed to a patient with TB without using appropriate precautions [Section II.K.3].

Any DW with a recent positive PPD test result should be evaluated promptly by a physician for TB infection or disease. DWs with symptoms consistent with active TB also should be evaluated promptly. Furthermore, they should not return to the workplace until their physicians have ruled out a diagnosis of TB or until they are receiving adequate therapy and are not infectious [Suppl.1].

PROBLEM EVALUATION [SECTION II.K]

This section provides general guidance for conducting epidemiologic investigations due to

- the occurrence of PPD test result conversions or active TB in HCWs;
- possible person-to-person transmission of TB;
- situations in which a patient who has undiagnosed active TB is treated in the dental office without appropriate precautions.

These investigations should focus on determining the extent of transmission of *M. tuberculosis* and on identifying people who have been exposed and should be evaluated for possible infection. The public health department should be able to perform contact investigations and PPD skin tests on exposed people and to assist DWs in identifying infection control interventions that could have prevented the exposure.

Dr. Cleveland is a dental officer and an epidemiologist, Division of Oral Health, National Center for Prevention Services, Centers for Disease Control and Prevention, Mailstop F-10, Atlanta 30333. Address reprint requests to Dr. Cleveland.

SUMMARY

The CDC guidelines offer recommendations that will reduce the risk of transmission of *M. tuberculosis* in health care settings and provide HCWs with educational material about TB. Although certain basic measures apply to all dental settings, these guidelines allow greater flexibility for implementing additional TB infection control measures on the basis of risk.

For dental settings, effective implementation of these recommendations will require the coordinated efforts of public health departments; local, state and national dental organizations; state dental directors; federal agencies; academic institutions; and individual dental practitioners. In addition, the process of implementing these recommendations must safeguard, in accordance with applicable state and federal laws, the confidentiality and civil rights of persons who have active TB. ■

Dr. Gooch is a dental officer, Division of Oral Health, National Center for Prevention Services, Centers for Disease Control and Prevention, Atlanta.

Dr. Marianos is division director, Division of Oral Health, National Center for Prevention Services, Centers for Disease Control and Prevention, Atlanta.

Ms. Bolyard is an epidemiologist, Hospital Infections Program, National Center for Infectious Diseases, Centers for Disease Control and Prevention, Atlanta.

Dr. Simone is deputy chief, Program Services Branch, Division of Tuberculosis Elimination, National Center for Prevention Services, Centers for Disease Control and Prevention, Atlanta.

Dr. Mullan is medical officer, HIV Activity, National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, Atlanta.

Single copies of the CDC guidelines and the Core Curriculum for Tuberculosis may be obtained by calling the CDC Voice Information System at (404) 639-1819.

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